

IN THE DRAWINGS:

Please replace drawing sheets having Figures 4(B), 5(B) and 9(A) with new drawing figures 4(B), 5(B) and 9(A) labeled as "Prior Art".

REMARKS

This amendment is submitted in response to the Notice of Non-compliant Amendment issued January 5, 2006 to correct the status designation of amended Claim 3 as being "Currently Amended". Otherwise, the contents of this amendment is identical to applicant's previously submitted amendment of December 20, 2005.

Favorable consideration and allowance of the claims of the present application are respectfully requested.

In the Office Action, the Examiner first acknowledges applicants election of Species IA claims 1-6 set forth in applicants response to the Restriction Requirement filed July 8, 2005. Thus, Claims 7-25 are being withdrawn from consideration.

In the Office Action, the Examiner objected to drawing Figure 4A, Figure 5B, and Figure 9A as not being properly labeled as Prior Art. Applicants in response submit new replacement sheets including Figures 4B, 5B and 9A with these figures labeled as "Prior Art".

The Examiner objected to drawings under 37 C.F.R. 1.84(p)(5) as they do not include a reference sign 400 as mentioned in the description. In response, applicants hereby amend paragraph [0005] as originally filed, with the amended paragraph that properly recites the structure of Figure 4A as element 40 (not 400) in order to conform with the drawing as originally filed. Respectfully, no new matter is being entered.

The Examiner further objected to drawings under 37 C.F.R. 1.84(p)(5) as they allegedly include reference numbers 53, 54 and 57 (in Figures 5A, 5B) that are not mentioned in the description. In response, applicants hereby amend paragraph [0006] as originally filed, with the amended paragraph including an added description of Figure 5B and elements 53, 54 and 57 directed to a conventional multi-layer conducting interconnect structure 50 having four

metal lines, 51, 53, 55 and 57, and their corresponding contact vias 52, 54 and 56. Metal line 51 and 55 are parallel to each other, but perpendicular to both metal lines 53 and 57.

Respectfully no new matter is being entered as the added language is fully supported by the Figures 5A and 5B as filed and tracks the language found in the paragraph [0005] which describes almost identical structure as shown in Figures 4A, 4B.

In view of the foregoing, the Examiner is respectfully requested to remove all of the objections to the drawings.

Further in the Office Action, the Examiner objected to Claim 1 as comprising various informalities. The applicants have amended Claim 1 to take care of the informalities as suggested by the Examiner and the Examiner is respectfully requested to remove the objection to amended Claim 1.

In the Office Action, the Examiner rejected Claims 1-6 under 35 U.S.C. §112, second paragraph, as allegedly being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention. Particularly, the Examiner takes issue to language present in the claims that speak to "enhancing" the mechanical strength of the semiconductor interconnect structure (Claim 1); exhibits "increased" resistance to electromigration, thereby "increasing" performance (Claim 2); exhibiting "improved" electromigration resistance (Claim 3); and "low-k" (Claim 4). The particularly alleges that these quoted terms are relative terms and thus indefinite.

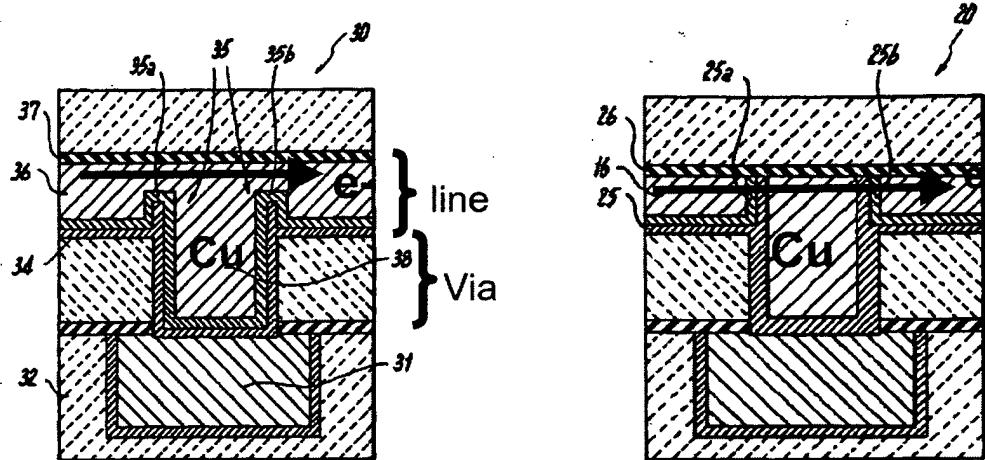
In response, Applicant hereby amends each of Claims 1 and 3, to remove the recitation of allegedly indefinite terms as indicated by the Examiner. Applicant further cancels Claim 2 without prejudice. With respect to the recitation of Claim 4 reciting a "low-k" value, applicants respectfully traverse as the "k"- value that constitutes a "low-k" material is well known to skilled artisans. Numerous "low-k" ($k < 4.0$) materials have been developed

and have been investigated by skilled artisans for use as the ILD materials in interconnect structures with low dielectric constants typically in the range of 2.7 to 3.3. As the present invention describes examples of low-k materials that could be used (see present specification at paragraph [0045]), e.g., doped TEOS, SiLK® (Trademark of Dow Chemical Co.) one skilled in the art will recognize low-k as a well-defined term and not indefinite.

Thus, in view of the foregoing, Applicants respectfully request the Examiner to withdraw the rejections of Claims 1-4 based on 35 U.S.C. §112, second paragraph.

Further in the Office Action, the Examiner rejected Claims 1-6 under 35 U.S.C. §102(b) as allegedly being anticipated by Wang et al. (U.S. Patent No. 6,383,920) (“Wang”).

Applicants respectfully disagree. As shown illustrated below, Figure 2 of the present drawings depict the embodiment described in Wang (e.g., corresponding to Figures 2H and 2L of Wang), which clearly shows, after a second chemical mechanical polish step, the resulting structure where the liner material 25, 25a and 25b completely blocks the electro path in the line level. In the present invention shown below, and as set forth in Claims 1 and 5, only a portion of the metal liner extends partially into an adjacent metal level of the first and second metal levels. Clearly, Wang does not teach or suggest such a feature. Wang show a process for fully encapsulating a copper via in a semiconductor device as a way to prevent void formation in the bottom of the via due to electromigration.



Present Invention

FIG. 2
Prior Art

However, the present invention enhances the electromigration resistance, i.e., slows down electromigration phenomena (see paragraph [0034] of the present specification) by extending a portion of the metal liner partially into an adjacent metal level of the first and second metal levels which structure is neither taught by nor suggested in Wang. This partial extension of the liner according to the invention forces electrons to go “around the fence” and flow down through the via that eliminating the current crowding effect and thus, less migration.

It is additionally submitted that the method steps as depicted in Figures 10A-10H for instance are clearly distinct from the methods as described in Wang (Figures 2B-2L,) and reiterate again that the formed barrier materials in Wang that are intended to fully encapsulate a via in a semiconductor device completely blocks the electro path in the line level. The claims of the present invention require that a portion of the metal liner partially

extends into an adjacent metal level of the first and second metal levels (no complete extension) and again this is neither taught nor suggested in Wang.

As such, the Examiner is respectfully requested to withdraw the rejection of Claims 1-6 as being anticipated by Wang.

In view of the foregoing remarks herein, it is respectfully submitted that this application is in condition for allowance. Accordingly, it is respectfully requested that this application be allowed and a Notice of Allowance be issued. If the Examiner believes that a telephone conference with the Applicants' attorneys would be advantageous to the disposition of this case, the Examiner is requested to telephone the undersigned, Applicants' attorney, at the following telephone number: (516) 742-4343.

Respectfully submitted,



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